

Revision of the Oriental and Nearctic Genus *Ellabella* (Lepidoptera: Copromorphidae)

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Abstract. The genus *Ellabella* Busck is revised, and two new species (*E. bayensis*, n. sp., and *E. johnstoni*, n. sp.) are added to the two described western Nearctic species (*E. editha* Busck and *E. melanoclista* (Meyrick)) and the single known Chinese species (*E. chalazombra* (Meyrick)). The genus is transferred to Copromorphidae. The host of one *Ellabella* species, *Mahonia* (Berberidaceae) (De Benedictis, 1984), and the distributions of *Ellabella* and *Mahonia* indicate that *Mahonia* or other Berberidaceae may be the hosts of the other species, including the Chinese *Ellabella*.

Introduction

The genus *Ellabella* has had an interesting history since its original description (Busck, 1925) and since the description of its two generic synonyms, *Probolacma* Meyrick (1927) and *Spilogenes* Meyrick (1938). Whereas *Ellabella* was originally described in the family Glyphipterigidae, the other two genera were described as Yponomeutidae (Heppner, 1982). Clarke ([1965]) later synonymized *Probolacma* with *Ellabella*, placing the genus in Ethmiidae, while leaving *Spilogenes* in Yponomeutidae. *Ellabella* was removed from Ethmiidae by Powell (1973). My initial studies of the genus prompted a transfer of *Ellabella* to Plutellidae (Heppner, 1978), yet *Ellabella* has remained an enigmatic group.

It was originally my belief, as that of Busck (1925), that *Ellabella* had some relationship with *Lotisma* Walsingham. Furthermore, I viewed both genera as belonging to the family Copromorphidae, a family not previously known to occur in the Nearctic region. *Ellabella* was placed in Plutellidae (Heppner, 1978), however, primarily because of a similarity in adult characters between *Ellabella* and another unusual genus, *Araeolepia* Walsingham. It is yet unclear if *Araeolepia* should remain in Plutellidae, but the newly discovered larval characters of *Ellabella* (DeBenedictis, 1984) support the view that *Ellabella* should be considered a copromorphid. One of the main reasons for this uncertainty is a lack of information. We do not yet know the immature stages of *Araeolepia* and, until recently, this was likewise the case for *Ellabella*. Another difficulty involves the lack of clear distinguishing family characters between Copromorphidae and Plutellidae that are consistent for the adults. Typical copromorphids have

¹Contribution No. 582, Bureau of Entomology, FDACS, Division of Plant Industry.

long radial and median veins in the forewings, maxillary palpi with only 1-2 segments, more porrect labial palpi than Plutellidae, and usually distinct scale tufts on the forewings, among other characters. Typical Plutellidae show largely the opposite character, notably 4-segmented maxillary palpi and rather upcurved labial palpi but with large medial scale tufts ventrally that simulate porrect palpi. *Ellabella* presents somewhat of a middle ground on adult characters, other than the unusual genitalia. Inasmuch as most plutellid larvae have a prothoracic L-group that is trisetose, and *Ellabella* larvae are bisetose (DeBenedictis, 1984), as are most other Copromorphidae larvae, it now appears more likely that the genus is a copromorphid.

The Plutellidae are too little studied on a world basis. The family limits of the Plutellidae have not yet been defined clearly enough and, thus, genera remain in Plutellidae that have characters atypical for the family: for example, the Galacticinae have 2-segmented maxillary palpi and bisetose larvae, as do a few other odd plutellid genera that conform to adult plutellid characters in general. The Yponomeutidae also require redefinition. A thorough generic study of world genera of Copromorphidae and Plutellidae, as well as Yponomeutidae, is needed in order to associate all the genera with these families and to redefine family limits.

In the present paper the Chinese species, *Ellabella chalazombra* (Meyrick), is redescribed and two new Nearctic species are described for a total of four Nearctic species. No other *Ellabella* are known thus far nor are any species known other than in east Asia or the New World, although it is probable that one or more of the United States species will also be found in northern Mexico. The disjunct distribution of *Ellabella*, as the genus is now delimited, does not appear so unusual in the light of the recent discovery of the host plant of the new California species by J. DeBenedictis (1984), since the host genus is also found in China. Such disjunct distributions between western North America and eastern Asia, are found in other western moths and among many plant groups. Among moths another example is the tribe Hilarographini of Tortricidae, in which North American species are very closely related to some species from Japan (Heppner, 1983). Among plants there are a number of so-called Tertiary relicts in western North America with affinities or nearest relatives in east Asia. Some American endemics are well-known examples: the redwoods, *Sequoia* and *Sequoiadendron* (Taxodiaceae), from California, have their nearest relative (*Metasequoia*) in China (Raven, 1977). This is likewise true for the host plant group of at least one *Ellabella*, in Berberidaceae: the single verified host is *Mahonia pinnata* (Lag.) Fedde. The plant genus *Mahonia* (some botanists consider this only a subgenus of *Berberis*) is distributed over much of montane North America at elevations of about 1300-3000 meters, although sometimes at lower elevations in areas such as coastal California. Figure 1 shows montane areas of North America at

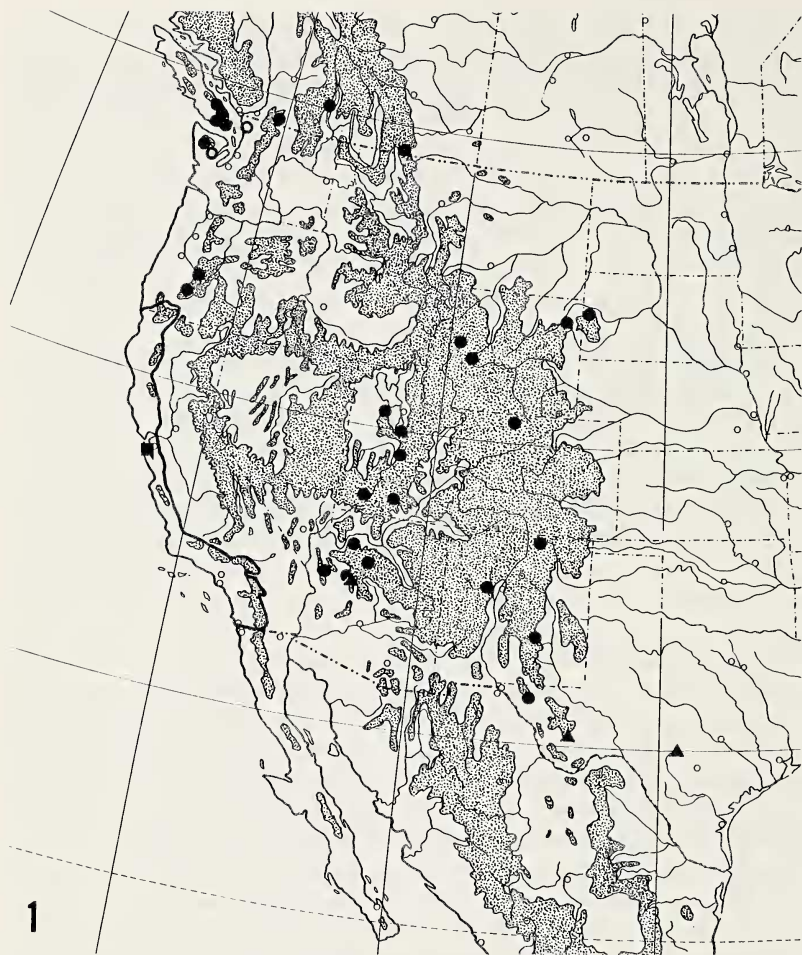


Fig. 1. Distribution map of *Ellabella* species in North America: *E. bayensis*, n. sp. [■]; *E. editha* Busck [●]; *E. johnstoni*, n. sp. [○]; *E. melanoclista* (Meyrick) [▲]. Shaded areas correspond to the 1500 meter elevation and also the approximate range of *Mahonia* plants. The demarcation line in California indicates the limit of distribution of *Mahonia pinnata*, the host of *Ellabella bayensis*.

approximately the 1500 meter contour line. This area (north of Mexico) corresponds fairly well to the distribution of North American *Mahonia* (Ahrendt, 1961). The known localities of *Ellabella* species in North America also correspond to this delimited area of montane habitats.

There are 50 known species of *Mahonia* in North America and east Asia. The distribution of *M. pinnata*, however, is limited to California and

southern Oregon (as indicated by the heavy line in Figure 1). Thus far the new species of *Ellabella* utilizing this host has not been collected outside of this distribution range. Likewise, a population of *Ellabella editha* (Busck), from Waterton Lakes, Alberta, indicates that a possible host is *Mahonia repens* (Lindl.) G. Don, since this is the only known species of *Mahonia* found in Alberta, and its overall distribution from Alberta and British Columbia to central Texas and Arizona coincides with the total distribution of *Ellabella editha*. One can only speculate that all *Ellabella* may be restricted to *Mahonia* species, since we do not yet know if the moths are restricted to only one species of *Mahonia*, or indeed even only to this single plant genus.

The *Mahonia* species of east Asia (Ahrendt, 1961) occur most frequently in the broadleaf evergreen forests of China and adjacent areas (after Wang, 1961), as shown in the shaded area of Figure 2. Figure 2 shows a plant association area and should not be confused with Figure 1, where an altitudinal limit is shown. The shaded area in Figure 2 also envelopes the single locality known for *Ellabella chalazombra*. Assuming the Chinese *Ellabella* utilizes a *Mahonia* as a larval host, then the moth species may be distributed more widely within the forest zone shown on the map. *Mahonia* does not occur naturally in Japan (it has been introduced as an



Fig. 2. Distribution map of *Ellabella chalazombra* (Meyrick) [Likiang, Yunnan, China] and the known limits of Oriental broadleaf evergreen forest [oaks, schima, laurels] [outside of Japan] where *Mahonia* species are concentrated [after Wang, 1961]. Outlying areas with *Mahonia* species in southern Asia include southern India [Nilgiri Hills], northern Sumatra, and the Philippines [Luzon].

ornamental), and inasmuch as Japanese collectors have very diligently surveyed Japan for moths, it appears that *Ellabella* does not occur in Japan. According to Ahrendt (1961), *Mahonia* has disjunct species in southern India (Nilgiri Hills), northern Sumatra, and the Philippines (Luzon), but no *Ellabella* have been found in these regions.

Ellabella Busck

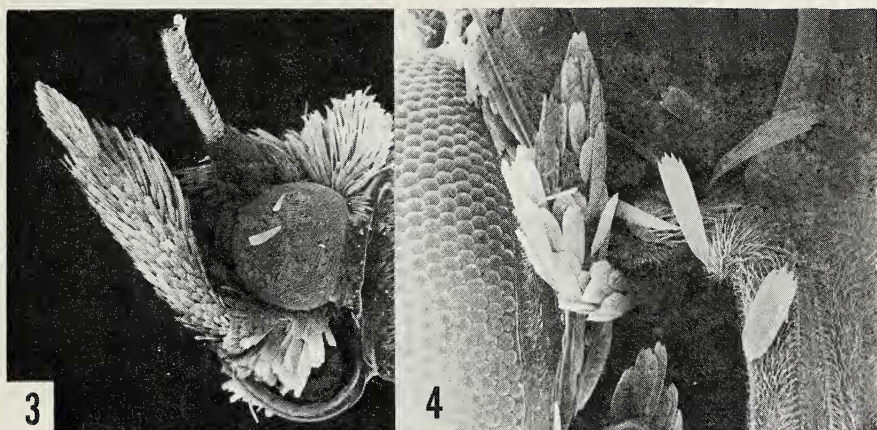
Ellabella Busck, 1925:46 (Type-species.-*Ellabella editha* Busck, 1925: 48, by original designation).

Probolacma Meyrick, 1927:362 (Type-species.-*Probolacma melanoclista* Meyrick, 1927:362, by monotypy).

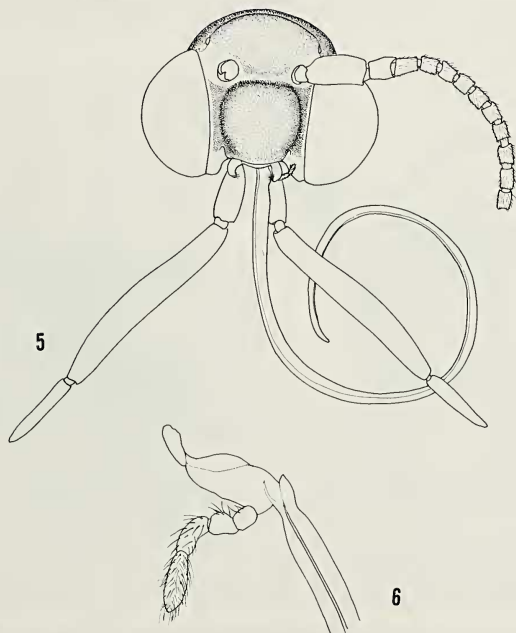
Spilogenes Meyrick, 1938:19 (Type-species.-*Spilogenes chalazombra* Meyrick, 1938:19, by monotypy).

Adult. Small moths, 8-13 mm forewing lengths. **Head** (Figure 3, 5): vertex with somewhat roughened scale tufts; frons smooth scaled; labial palpus straight, somewhat upwards tilt (often held in porrect position), with long median segment (usually ca. 3X length of short apical segment); maxillary palpus (Figures 4, 6) prominent, 4-segmented; haustellum large, unscaled; pilifer large; compound eye large; ocellus very small (in relation to compound eye); antenna (Figures 3, 5) filiform with short ventral setae, length of antenna about $\frac{1}{2}$ forewing length, little sexually dimorphic; antennal scape lacking pecten. **Thorax:** normal but with large dorsal median scale tuft; legs with 0-2-4 tarsal formula. **Forewing** (Figure 7): elongate with pointed apex, oblique termen and rounded tornus; all veins present and separate; R^5 to termen near apex; chorda vestigial; M_1 convergent with M_2 at base; CuA_1 and CuA_2 curved and parallel; CuP present near tornus; A_1+2 with short basal fork; A_3 very small. **Hindwing** (Figure 7): elongate, subovate, with blunt pointed apex and slightly oblique termen; all veins present; R_s separate from Sc ; median veins equidistant; M_3 convergent with CuA_1 at base (more separate in *E. chalazombra*); CuA_1 and CuA_2 relatively straight and parallel; CuP long, from termen; A_1+2 curved, with small basal fork; A_3 long; A_4 minute.

A_4 minute. **Abdomen:** normal but males with two pairs of large ventral coremata, one pair on sternite 2 (Fig. 8) and one pair between sternites 7 and 8, the latter pair in internal pouches (Fig. 9); posterior coremata have exterior sclerotized borders along anterior margin of pouch openings, shaped as two half circles meeting at a median notch. **Male genitalia:** uncus and gnathos well developed; gnathos with two strong lateral arms joined distally as spined ends; socius absent; transtilla strong but tending to be incompletely fused medially; valva relatively simple, setaceous and elongate, with small carinate ridges or relatively smooth; anellus a V- or U-shaped plate with variously shaped appendages and median spined juxta; tegumen normal; vinculum reduced, quadrate; saccus undeveloped; aedeagus elongate, with phallobase and single cornutus. **Female genitalia:** ovipositor of average length (not noticeable elongated or shortened for the total genitalia size); setaceous papilla analis; apophyses stout, anterior pair shorter than posterior pair and usually stronger; posterior genital plate with varying degree of projecting central point (flat on sternite); ostium a simple membranous funnel leading to a membranous ductus bursae having a sclerotized collar near the entrance of the ductus seminalis; corpus bursae simple, ovate; signum a rugose plate with short



Figs. 3-4. Head morphology of *Ellabella editha* Busck: 3, profile; 4, detail of haustellum base, maxillary palpus, and pilifer [USNM slide 77334, South Dakota].



Figs. 5-6. Head morphology of *Ellabella editha* Busck: 5, head frontal view; 6, detail of maxillary palpus and haustellum [USNM slide 77710, British Columbia].

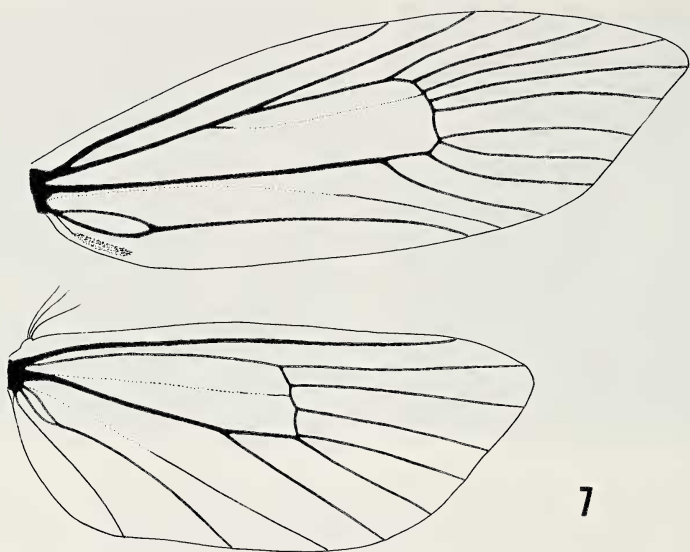
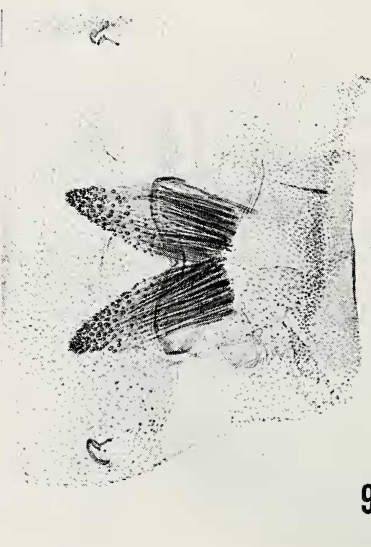
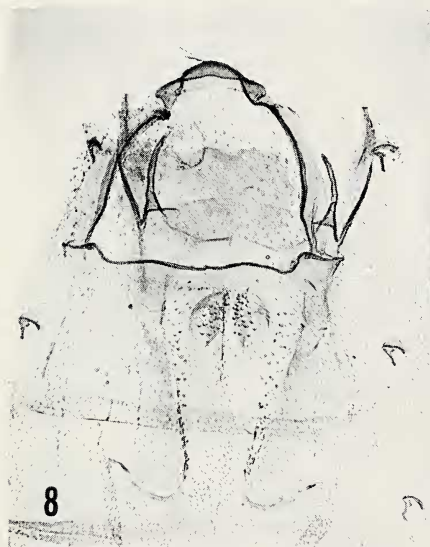


Fig. 7. Wing venation of *Ellabella editha* Busck, ♀ [USNM slide 77374, British Columbia].



Figs. 8-9. Abdominal details of *Ellabella editha* Busck: 8, abdominal articulation and anterior coremata of male [coremata hairs removed] [USNM slide 77117, South Dakota]; 9, posterior coremata of male [USNM slide 77116, British Columbia].

spines.

Immature Stages. Larvae bisetose (rarely trisetose); leaf rollers on new foliage (the description is the subject of the following paper by J. De Benedictis).

Distribution. China (Yunnan); western United States and Canada.

Remarks. There are no close relatives of *Ellabella* known and, as noted previously, it remains unclear if *Araeolepia* actually belongs in the same family as a relative of *Ellabella*. The genitalia of *Araeolepia* have superficial similarity to *Ellabella* but other characters relate the genus, to Plutellidae. There may be some relation of *Ellabella* to *Lotisma* but the two genera do not appear very closely related. *Spilogenes* was described as a monobasic genus from China but the morphological features of this genus, including wing venation, head morphology, and genitalic morphology, clearly show relationship to other *Ellabella*.

Other species of *Ellabella*, in addition to the five known thus far, may yet be found in east Asia and northern Mexico. *Ellabella* moths may tend to remain in the vicinity of their larval hosts, and the consequent colonial nature of such local populations may be a factor in their infrequent collection.

Synopsis of *Ellabella*

	Type-Locality
<i>Ellabella</i> Busck, 1925	
<i>Probolacma</i> Meyrick, 1927	
<i>Spilogenes</i> Meyrick, 1938	
<i>chalazombra</i> (Meyrick, 1938) (<i>Spilogenes</i>)	China (Yunnan)
<i>bayensis</i>, n. sp.	USA (California)
<i>johnstoni</i>, n. sp.	USA (Washington)
<i>melanoclista</i> (Meyrick, 1927)	USA (Texas)
(<i>Probolacma</i>)	
<i>editha</i> (Busck, 1925)	Canada (British Columbia)

***Ellabella chalazombra* (Meyrick)**

Spilogenes chalazombra Meyrick, 1938:19.

Ellabella chalazombra (Meyrick).-Heppner, 1978:50.

The large, broad gnathos arms in the male genitalia and the very long ductus bursae in the female genitalia will easily distinguish this species from other *Ellabella*. The wing maculation is the most distinctive in the genus.

Forewing length: 10-11 mm (♂); 10.5 mm (♀). **Male.**—**Head:** vertex dark brown, with yellow-tan scales on lateral areas posterior to antennae and on relatively smooth frons; antenna light tan; labial palpus buff with whitish tan on

mesal side; labial palpus with long slightly curved median segment (3x length of short apical segment). **Thorax:** patagia and dorsum of thorax white, with dark brown spots on anterior ends of patagia; legs buff; venter mostly white, with buff mixed in. **Forewing** (Figure 10): basal half of wing white-tan irrorated with brown spots along radius and near anal margin and tawny suffusion over dorsal half; dark brown at mid-wing from costal margin diagonally to wing center, then narrowing to CuP fold; dark brown area irrorated with orange-brown scales; dark brown spot of cubitus at $\frac{1}{2}$ from wing base; apical $\frac{1}{2}$ of wing with 3 dark brown dashed streaks toward apex from mid-wing area; tan with white suffused line distad of mid-wing; dark brown area and between brown markings near termen; orange-brown suffusion at end of discal cell and dark brown spot on cubitus at $\frac{1}{2}$ from wing base; apical area along costal margin with 3 brown marks; termen with 5 dark brown marks situated between median and cubital veins, with white spots splitting each mark; fringe brown and white; venter gray-brown. **Hindwing:** uniform gray-brown; venter similar; fringe brown and white. **Abdomen:** buff dorsally and somewhat whitish ventrally. Males with small posterior coremata in small pouches with pouch borders small. **Male genitalia** (Figure 22): uncus a long finger-like projection with a widened base having numerous setae laterally on base; gnathos a pair of broad, flat arms, fused at apex as a densely spined area; tegumen simple, widening from uncus base to valval joints; vinculum quadrate; valvae relatively simple, elongate, with rounded and somewhat membranous setaceous distal ends; valvae merging to strong transtilla with pointed ends not entirely fused at center; anellus V-shaped, narrow with pointed distal ends; aedeagus (Fig. 23) straight, with phallobase and apical projection; cornutus a small blade-like structure.

Female (Figure 11).—Wing pattern and other coloration the same as in the male, only with white somewhat more pronounced on basal $\frac{1}{2}$ of wing near anal margin. **Female genitalia** (Figure 34): ovipositor of average length, with setaceous papilla analis; posterior apophyses longer than anterior apophyses, both very stout; anterior apophyses forming ventral triangular sternal plate not quite fused medially; ostium (Fig. 35) membranous, leading to sclerotized half-ring just anterior to it and at juncture with ductus seminalis; ductus bursae twice length of ovipositor, membranous and relatively narrow; bursa copulatrix ovate; signum a small ventral rugose, flat plate.

Immature Stages. Unknown.

Host. Unknown.

Distribution. China: Yunnan.

Flight Period. June-July.

Type. Lectotype ♂ (BMNH). Likiang, Yunnan, China, VI-VII, 2800-3200 m. (lectotype designated by Clarke, [1965]:384).

Material Examined. (8♂, 1♀). China: Yunnan. Likiang, VI-1934 (♂ - USNM; 2♂ - BMNH), H. Hoene; 11-VI-1-VII-1934 (5♂, 1♀), H. Hoene, 2800-3200 m (MGAB) [all paralectotypes].

Remarks. *Ellabella chalazombra* has been collected only once at one site in Yunnan, China. The shaded area of Figure 2 may represent the possible total distribution of *E. chalazombra*, inasmuch as the site is situated within the broadleaf forest delimited on the map where possible *Mahonia* hosts also occur.

The reduced development of the posterior coremata in *E. chalazombra*

may indicate that this species is the most primitive species of the genus. A species of *Anchinia* (Oecophoridae) in China is superficially very similar to *E. chalazombra* in wing maculation, but other characters will easily distinguish the two species.

***Ellabella bayensis* Heppner, n. sp.**

This new species is one of three North American *Ellabella* with a small scleroized collar on the female genital ductus bursae. The male has anellus appendages with rounded ends. The wing maculation is distinctive in having the entire forewing base tan-white, not just the costal half as in the other North American species.

Forewing length: 8.2-11.0 mm (♂); 8.8-10.8 mm (♀) [one dwarf at 6.5 mm].

Male.—**Head:** vertex tan mixed with brown, tan laterally; frons smooth scaled, silvery tan; antenna tan; labial palpus brown and tan mottled on sides, tan on mesal side, with median segment having scales making it appear twice actual width; median segment of labial palpus slightly curved and about 2.5-3x length of small apical segment. **Thorax:** tan mixed with white and brown; patagia pale tan, with dark brown anterior border, followed by mostly white; venter mostly white; legs brown and tan, with brown and white on tarsal segments. **Forewing** (Figure 12): brown irrorated with tan and white scales as in *E. chalazombra*; basal ½ of wing with more white evident, somewhat surrounding dark brown mark from costa to CuP fold, sometimes somewhat split centrally by buff area; 4-5 dark brown costal marks on apical half of wing, with spotted streaks along radial veins more or less prominent; chocolate brown marks on basal ½ on Rs and at end of cell by M₁ and by CuA₁ and CuA₂ (or dark brown vertical line at end of cell, with a small dark brown spot between it and mid-wing large dark spot); termen with spotted dark brown lines between veins and veins highlighted by brown lines; fringe tan; venter gray-dark brown. **Hindwing:** uniformly pale gray-tan; fringe same; venter dark gray-tan. **Abdomen:** tan; venter tan mixed with white; posterior coremata in male long, with pouch borders larger than in *E. editha* and with long central notch. **Male genitalia** (Figure 24): as in *E. chalazombra*, with elongated uncus on widened setaceous base; gnathos as a pair of stout, flattened appendages less wide than in *E. chalazombra*; valvae simple, elongate-oblong, setaceous with rounded distal ends, with sacculus having small sharp projection which is separated from a mid-valval slightly carinate ridge; anellus U-shaped with distal appendages rounded and broad; aedeagus (Fig. 25) slightly angulate, with half-phallobase; cornutus a curved spine.

Female (Figure 13).—Same as male. **Female genitalia** (Figure 36): ovipositor of average length, with setaceous papilla analis; apophyses with posterior pair twice length of anterior pair; sternal plate of segment 8 with prominent central point; ostium (Fig. 37) a wide membranous funnel, relatively short before terminating at sclerotized collar on ductus bursae posterior to entrance of ductus seminalis; ductus bursae subequal in length to corpus bursae, membranous and slightly convoluted; corpus bursae ovate, with small rugose plate as signum.

Immature Stages. Larvae and pupae known; foliage feeders from silk-tied shelters (description in following paper by J. De Benedictis).

Host. *Mahonia pinnata* (Lagasca) Fedde (Berberidaceae).

Distribution. California (San Mateo Co.).

Flight period. January-March (rearing records); March (wild collected moth).

Type. Holotype ♂ (UCB). San Bruno Mt., San Mateo Co., California, larvae 21-IV-1981, emerged 8-II-1982 ex *Mahonia pinnata* (J. Powell lot 81D41), J. A. De Benedictis coll. (Holotype deposited with CAS on indefinite loan from UCB).

Material examined. Paratypes: (1♂, 11♀). USA: California. San Mateo Co.: San Bruno Mt., 2-III-1967 (1♂), P.A. Opler (UCB); larvae 21-IV-1981, (8♂, 10♀), emerged 5-I-4-III-1982 (also 6 from 20-VI to 27-XII-1981) ex *Mahonia pinnata* (J. Powell lot 81D41) (UCB); larvae 15-IV-1981 (2♂, 1♀)k, emerged 15-XII-1981 and 11-14-I-1982 ex *Mahonia pinnata* (J. Powell lot 81D36) (UCB).

Remarks. This California species is very closely related to *Ellabella johnstoni*, n. sp., from Washington state. *Ellabella bayensis* is distinct in wing pattern and genitalic details, and the range of the known host also appears to indicate that the two species are distinct. The known range of *Mahonia pinnata* is shown on Figure 1 as a delimited area in California to extreme southern Oregon (Josephine Co.) and extending to the Mexican border. It is probable that both the host and the moth also occur south of the border in Baja California. Only a single generation per year (January-March) is confirmed thus far although laboratory rearings have produced moth emergences from June until December as well.

***Ellabella johnstoni* Heppner, n. sp.**

A species from Washington state that is noticeably larger than other *Ellabella*. The species has a dark forewing base, but other maculation is similar to *E. bayensis*.

Forewing length. 11.0-13.0 mm (♂); 11.5 mm (♀).

Male.—**Head:** vertex as in *E. bayensis* with tan and brown; frons brown to dark brown; labial palpus brown and tan, mostly tan on mesal side; antenna tan and brown; labial palpus with median segment long and straight (ca. 3x small apical segment), with dorsal scale tuft. **Thorax:** brown and tan mixed, with median dark brown tuft merged laterally to form dark line across patagia; posterior of thorax dorsum tan and white; patagia with posterior end tan and white; venter mostly white, with some tan; legs brown and tan, white on mesal sides. **Forewing** (Figure 14): ground color tan with dark brown area on most of mid-wing area from CuP fold to costal margin; a tan area (with some chocolate brown scales) at mid-wing, with a central dark brown spot or short line; another dark brown line at end of discal cell (vertical) and a small dark brown spot (irrorated white) along cubitus basad of cell end line; 4 costal dark brown marks (irrorated with white) on apical ¼; intervein spaces along termen with dark brown lines, irrorated with some white; fringe brown and white; venter gray brown. **Hindwing:** uniform pale gray-tan; venter gray brown; fringe tan and white. **Abdomen:** brown and tan; venter somewhat lighter; male posterior coremata longer and thinner than those of *E. bayensis*, otherwise with similar pouch border shape. **Male genitalia** (Figure 26): very similar to *E. bayensis* but about 30% larger; gnathos arms somewhat more stout; valvae more oblong and rounded on distal ends; valval saccular projection rounded and carinate ridge almost absent; annelus appendages similar to *E. bayensis* but with distal ends blunted to slight point; aedeagus (Fig. 27) with cornutus relatively straight.

Female (Figure 15). Similar to male. **Female genitalia** (Figure 38): similar to *E.*

bayensis but in general larger, with anterior apophyses somewhat longer; sternal plate (Fig. 39) of segment 8 with base curved more toward central projection than the almost abrupt juncture in *E. bayensis*.

Immature stages. Unknown.

Host. Unknown.

Distribution. Washington.

Flight period. April-May.

Type. Holotype ♂ (CNC). Stimson Cr., Mason Co., Washington, 17-IV-1949, E.C. Johnston.

Material examined. (3♀). USA: Washington. Mason Co.: Stimson Cr., 17-IV-1949 (1♀), 22-V-1949 (1♀), E.C. Johnston (CNC). Whatcom Co.: Bellingham, 14-IV-1927 (1♀), J.F.G. Clarke (USNM) [all paratypes].

Remarks. This species of *Ellabella* occurs near localities from which *Ellabella editha* was described, yet has been very rarely collected. It is noticeably larger than other *Ellabella* but is closely related to *E. bayensis*. There also is an apparent close relationship with *Ellabella melanoclista* (Meyrick) in some of the wing markings and some genital features, such as the valval carinae and annellus of the male.

The species is named in honor of E. C. Johnston, who collected many unusual moths in the Pacific Northwest.

***Ellabella melanoclista* (Meyrick)**

Probolacma melanoclista Meyrick, 1927:362.

Ellabella melanoclista (Meyrick).—Clarke, [1965]:418.

A dark southwestern species, with male genitalia having truncated valvae.

Forewing length. 9.6-11.2 mm (♂), 10.0-11.2 mm (♀).

Male.—**Head:** vertex and frons dark brown mixed with black and white; antenna dark brown; labial palpus dark brown, with white mixed in on both sides or lighter on mesal side; labial palpus with median segment having apical tuft and about 2.5x length of small apical segment. **Thorax:** dark brown mixed with black, with scales white-tipped; patagia same; venter white; legs dark brown to black. **Forewing** (Figure 16): dark brown to black irrorated with some white near base, around the three mid-wing black marks (as in *E. johnstoni*), and on apical ¼; apical ¼ sometimes with veins highlighted by brown or white irrorations; termen marks indistinct, sometimes as broken subterminal lines; fringe brown and white; venter dark gray brown. **Hindwing:** uniform pale gray-brown; fringe brown and white; venter gray brown. **Abdomen:** gray-brown; venter lighter; male posterior coremata long and large, with pouch borders not as convex anteriorly as in *E. johnstoni* but with similar central notch. **Male genitalia** (Figure 28): similar to *E. bayensis* but smaller, with shorter uncus; valvae distinctly truncated apically, with saccular projections rounded and valval carinate ridge very slight; annellus appendages similar to *E. johnstoni* but somewhat more pointed; aedeagus (Fig. 29) with curved cornutus.

Female (Figure 17). Similar to male but sometimes with more extensive white suffusion over wings. **Female genitalia** (Figure 40): similar to *E. bayensis* and *E. johnstoni* but smaller overall yet with proportionally larger corpus bursae; signum (Fig. 42) somewhat larger and more concave.

Immature stages. Unknown.

Host. Unknown.

Distribution. Arizona to Texas.

Flight period. March-May.

Type. Holotype ♀ (BMNH). Alpine, Brewster Co., Texas, IV-1926, 5000 ft. [1520 m].

Material examined. (3♂, 3♀). USA: Arizona. Yavapai Co.: Prescott, 30-III-1971 (1♀), 7-IV-1970 (1♂), L.M. Martin (UCB); 5 mi. N. Prescott, 11-IV-1974 (1♂, LACM), 2-V-1974 (1♂, LACM), 9-V-1974 (1♀, UCB), L.M. Martin, 5450 ft. [1680 m]. Texas. Kerr Co.: Kerrville, III-1907 (1♀), H. Lacy (USNM).

Remarks. *Ellabella melanoclista* is another rarely collected species that only recently has been found more frequently in Arizona. This species may well also be found in adjacent upland areas of juniper woodland in northern Mexico. The moths appear somewhat like melanic *E. johnstoni* but the genitalia are noticeably distinct. The female from Kerrville appears to be *E. melanoclista* inasmuch as the genitalia do not show the long ductus bursae collar of *E. editha*, yet the wing maculation has much more white than is typical (this may be due to the removal of darker scales following prolonged flight).

***Ellabella editha* Busck**

Ellabella editha Busck, 1925:48.

This widespread species is most readily distinguished by the more evident forewing scale tufts and in the genitalia. The male genitalia show anellus appendages with truncated distal ends and mesal points, while female genitalia show a long sclerotized collar on the ductus bursae.

Forewing length. 9.5-11.0 mm (♂), 8.0-11.5 mm (♀).

Male.—**Head:** similar to *E. bayensis*, with vertex and frons tan and brown; antenna white and tan; labial palpus brown mixed with white, mostly white on mesal side; median segment of labial palpus long (ca. 3x length of short apical segment) and straight. **Thorax:** brown and white, with median tuft and posterior tuft of dark brown; patagia brown and white, with more or less distinct median line of dark brown; venter white; legs white and brown with some dark brown areas. **Forewing** (Figure 18): similar to *E. bayensis*, with gray-brown irrorated with white and more extensive white on apical ¼ and basal ½ along costal margin; a large mid-wing area of dark brown mixed with tan, with chocolate-brown along radius and cubitus; 2-3 black tufted spots in cell separated by dark brown mixed with tan or white; a small dark brown spot between basal two tufts but indistinct; white line at end of cell and bordering distal of black spots vertically; apical ¼ irrorated with white over gray-tan, with few distinct marks except for two parallel subterminal lines (usually irregular) of brown and tan but these often indistinct; streaks of brown and tan sometimes distinct on apical ¼ (Fig. 20); fringe gray-brown and white; venter brown. **Hindwing:** uniform gray-brown; fringe brown and white; venter darker. **Abdomen:** tan and brown; venter somewhat lighter; male posterior coremata (Fig. 9) very short, with pouch borders having small median notch. **Male genitalia** (Figures 30, 32): similar to *E. bayensis* but with uncus shorter; gnathos with lateral

arms narrower and distal spined pads wider; valvae elongate, with distal ends not enlarged, sometimes narrower than middle area (Fig. 32); valval saccular projection carinate and central carinate ridge elongated; annellus with widely separated appendages, broader than in *E. bayensis*, and with truncated ends with a sharp mesal point; aedeagus angulate with small phallobase; cornutus a curved spine.

Female (Figures 19, 21). Similar to male but tending to have more white on head, body and wings. **Female genitalia** (Figure 43): similar to *E. bayensis* and other North American species but with sternal plate of segment 8 having curved base; ductus bursae with elongated sclerotized collar (ca. 3x longer than in other species); signum (Fig. 44) subovate, with rugose spines more fused than in other species; corpus bursae noticeably larger than in other species.

Immature stages. Unknown.

Host. Unknown (possibly *Mahonia repens* (Lindl.) G. Don which is the only *Mahonia* in Alberta).

Distribution. Canada (Alberta and British Columbia); USA (Arizona, Colorado, New Mexico, Oregon, South Dakota, Texas, Utah, Washington, Wyoming).

Flight period. May-August (most records for June-July).

Type. Holotype ♀ (USNM). Saanichton, Vancouver Id., British Columbia, Canada, 10-VI-1922, J.G. Colville.

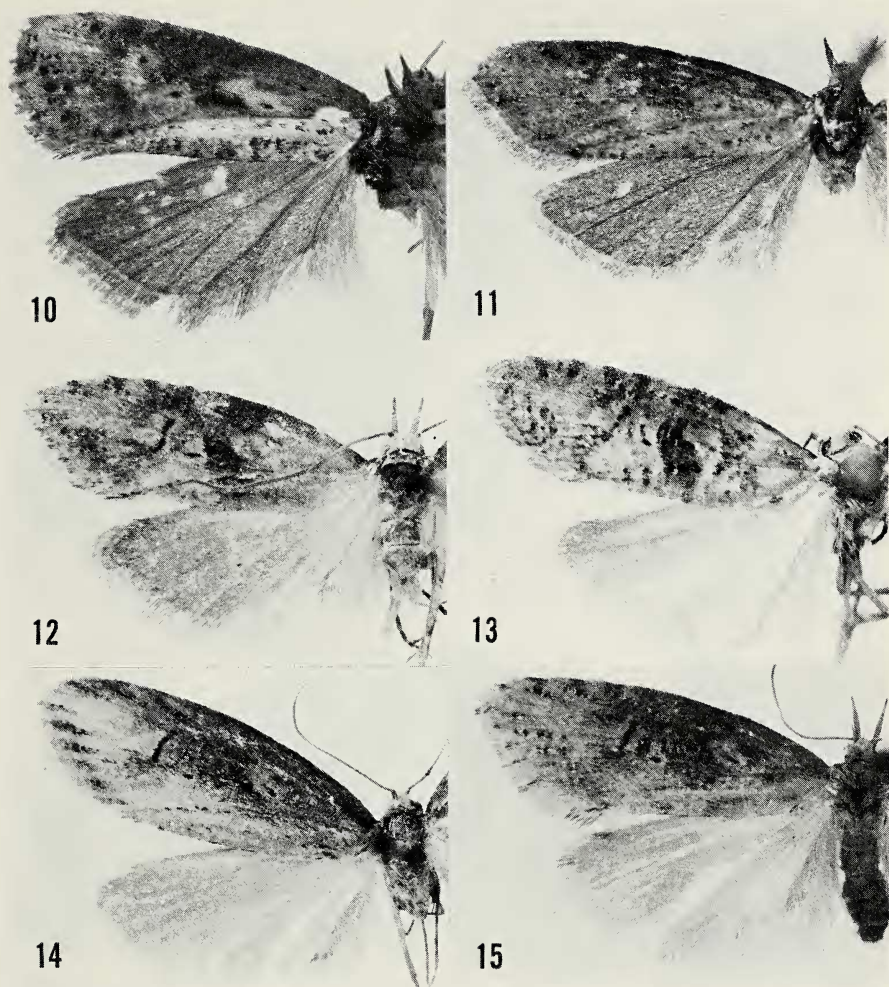
Material examined. (44♂, 26♀). Canada: Alberta. Waterton Lakes, 8-VII-1923 (1♂), 13-VII-1923 (1♀ paratype), 24-VII-1923 (1♀), J.H. McDunnough (CNC). British Columbia. Kaslo, 4-VI-1904 (1♂, ANSP), 12-VI-1906 (1♂, AMNH), VII-1924 (1♂, USNM), J.W. Cockle. Keremeos, 9-VI-1935 (1♀, UCB), 30-VI-1936 (1♀, UCB; 1♂, CNC), A.N. Gartrell. Penticton, 25-VI-1935 (1♀), A.N. Gartrell (CNC). Vancouver Id.: Quamichan Lk., [no date] (2♂ paratypes), 27-V-1902 (1♂), 3-VI-1914 (1♂), E.H. Blackmore (USNM); [no date] (1♂ paratype), E.H. Blackmore (UCB); Saanichton, 22-VI-1922 (1♀ paratype), E.H. Blackmore (USNM); Shawnigan, 23-VI-1925 (1♀), E.H. Blackmore (USNM); Victoria, 28-VI-1921 (1♀), W.R. Carter (USNM); Brentwood, 30-VI-1923, (1♂), E.H. Blackmore (USNM); Mt. Newton, 2-VIII-1924 (1♀), E.H. Blackmore (UCB); [no locality], 1-VI-1905 (1♂), 16-VI-1909 (1♂), E.H. Blackmore (USNM).

USA: Arizona. Coconino Co.: Fort Valley, 7½ mi. NW Flagstaff, 20-VI-1961 (1♂), 25-VII-1961 (1♂), 13-VIII-1961 (1♂), 17-VIII-1961 (1♂), 18-VIII-1961 (1♂), R.W. Hodges, 7350 ft. [2275 m], (USNM); 52 mi. N. Williams, 26-VIII-1968 (2♀), C. Slobodchikoff (UCB). Mohave Co.: [no locality], 1-7-VIII (1♀), [no coll.] (USNM). Yavapai Co.: 5 mi. N. Prescott, 4-VI-1973 (1♂), L.M. Martin, 5450 ft. [1680 m] (LACM). Colorado. Jackson Co.: Gould, 11-VIII-1956 (1♂), F. & P. Rindge, 9000 ft. [2750 m], (AMNH). New Mexico. Colfax Co.: Cimarron Cyn., Sangre de Cristo Mts., 6-VII-1962 (1♂), E. & I. Munroe, 7900 ft. [2400 m] (UCB). Lincoln Co.: Nogal Lk. Cpgd., 4 mi. SE. Nogal, 4-VII-1977 (1♀), J.B. Heppner, 7000 ft. [2135 m], (JBH). Sandoval Co.: Horseshoe Spgs. Camp, 2 mi. W. La Cueva, 28-VII-1961 (1♀), F., P. & J. Rindge, 7900 ft. [2400 m] (AMNH). Oregon. Douglas Co.: Whitehorse Falls Cpgd., 12 mi. NW. Diamond Lk., 30-VII-1982 (2♂), J. De Benedictis & J. A. Powell, 3800 ft. [1160 m], (UCB). Lane Co.: Alder Spgs. Cpgd., 11 air km. E. Belknap, 31-VII-1982 (3♂), J. De Benedictis & J. A. Powell, 3500 ft. [1070 m] (UCB). South Dakota. Pennington Co.: Hardy Work Ctr., 20-VII-1965 (3♂), 21-VII-1965 (2♂), R.W. Hodges (USNM). Texas: Culberson Co.: Sierra Diablo, 20 mi. NW. Van Horn, 27-V-1973 (2♀), 30-V-1973 (1♀), R.W. Hodges, 6000 ft. [1825

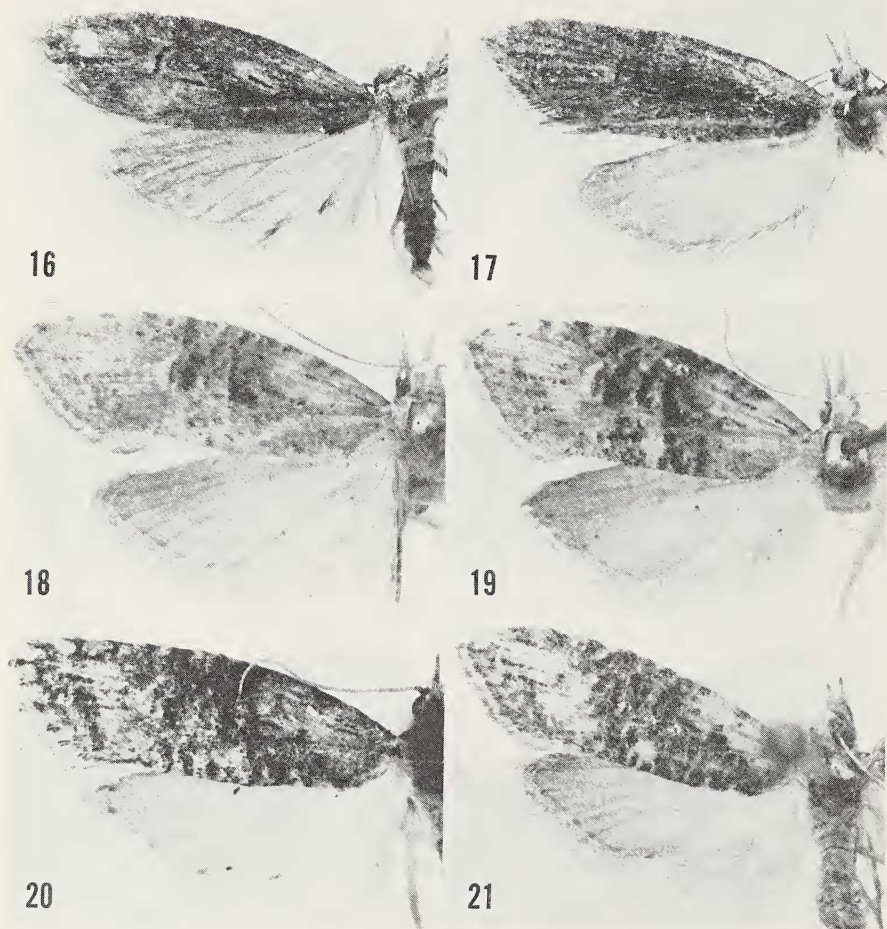
m] (USNM). Utah. Garfield Co.: Blue Spruce Camp, 18 mi. N. Escalante, 2-VII-1963 (1♂), F., P. & M. Rindge, 8000 ft. [2415 m] (AMNH); Red Cyn. Camp, 11 mi. SE. Panguitch, 31-VII-1965 (1♀), F., P. & M. Rindge, 7100 ft. [2150 m] (AMNH). Provo Co.: Provo, 19-VII-1909 (1♂), T. Spalding (AMNH). Sanpete Co.: Ephraim Cyn., Grt. Basin Exp. Sta., 19-VII-1981 (1♀), 21-23-VII-1981 (1♂), R.W. Hodges, 8850 ft. [2700 m] (USNM). Tooele Co.: Loop Camp, 13 mi. SW. Grantsville, 1-VII-1960 (1♂, 1♀), F., P. & B. Rindge, 7400 ft. [2250 m] (AMNH). Washington. Jefferson Co.: Rosemary Inn, Olympic Mts., 21-VI-1939 (1♀, UCB), 22-VI-1939 (1♂, AMNH), 28-VII-1939 (1♂, 1♀, USNM), G.H. & J.L. Sperry. Wyoming. Crook Co.: Reuter Cyn. Camp, 5 mi. N. Sundance, 11-VII-1962 (1♂), F., P. & M. Rindge, 5900 ft. [1790 m] (AMNH). Fremont Co.: Louis Lk., 28 mi. SW. Lander, 30-VII-1962 (1♂), 1-VIII-1962 (1♂, 1♀), 2-VIII-1962 (1♂), 4-VIII-1962 (1♂, 1♀), 5-VIII-1962 (1♂), F., P. & M. Rindge, 8600 ft. [2625 m] (AMNH). Sublette Co.: Lower Green R. Lk., Wing River Range, 30-VII-1953 (1♀), F. & P. Rindge, 8000 ft. [2435 m] (AMNH).

Remarks. *Ellabella editha* is the type-species of the genus and also the most widespread. Although ranging from British Columbia and Alberta to Arizona and Texas, it is uncertain whether it occurs in Mexico. A possible host, *Mahonia repens*, is not known to occur south of central Arizona and southern New Mexico. Both *Ellabella johnstoni* and *E. melanoclista* have earlier flight periods than most records indicate for *E. editha*, with May being the only month of possible overlap in areas where any two of the species occur. In Prescott, Arizona, *E. melanoclista* flies from March to April, however, and *E. editha* has been recorded there only in June. The genital differences between the two species would not make it possible to consider them only seasonal forms.

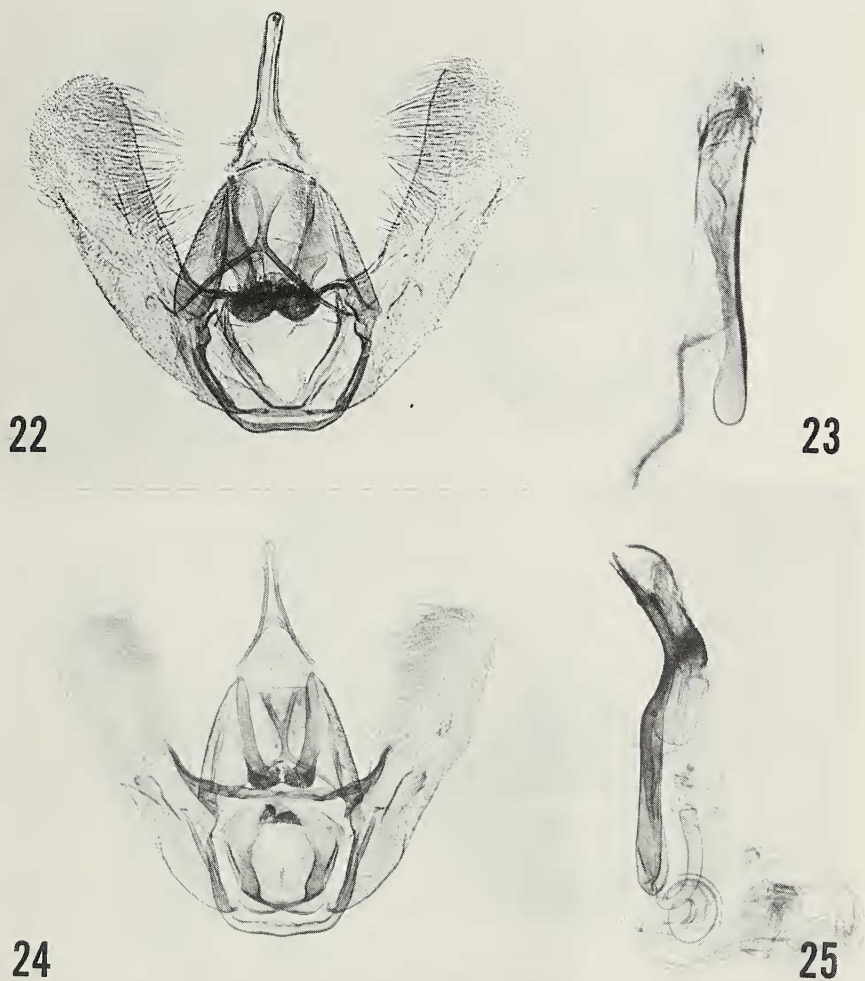
Acknowledgments. The following persons and institutions kindly provided specimens of *Ellabella* for study other than from my own collection (JBH): P. T. Dang, Canadian National Collection, Agriculture Canada, Ottawa, Canada (CNC); D. R. Davis, Smithsonian Institution, Washington, D. C. (USNM); J. P. Donahue, Los Angeles County Museum of Natural History, Los Angeles, California (LACM); D. Otte, Academy of Natural Sciences, Philadelphia, Pennsylvania, (ANSP); A. Popescu-Gorj, Muzeul de Istorie Naturala "Grigore Antipa," Bucharest, Romania (MGAB) (Caradja Coll.); J. A. Powell, University of California, Berkeley, California (UCB); F. H. Rindge, Jr., American Museum of Natural History, New York (AMNH); and K. Sattler, British Museum (Natural History), London, England (BMNH). I thank the Smithsonian Institution for providing facilities for the completion of this study. D. R. Davis (Smithsonian Institution) and J. De Benedictis (Univ. of California, Berkeley) kindly reviewed the manuscript, and the latter is thanked for providing information on the immature stages and host plant of *Ellabella bayensis*.



Figs. 10-15. Adults of *Ellabella*: 10, *E. chalazombra* [Meyrick], ♂ paralectotype, Yunnan, China (USNM); 11, same, ♀ (MGAB); 11, *E. bayensis*, n. sp., ♂ paratype, California (UCB); 12, same, ♀ paratype (UCB); 13, *E. johnstoni*, n. sp., ♂ holotype, Washington (CNC); 14, same, ♀ (USNM).



Figs. 16-21. Adults of *Ellabella*: 16, *E. melanoclista* [Meyrick], ♂, Arizona [UCB]; 17, same, ♀ [UCB]; 18, *E. editha* Busck, ♂, British Columbia [USNM]; 19, same, ♀ holotype [USNM]; 20, same, ♂, Arizona [USNM]; 21, same, ♀, Texas [USNM].



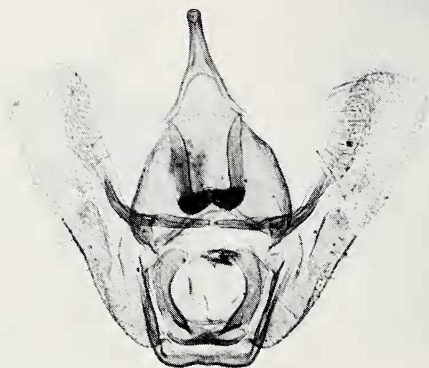
Figs. 22-25. Male genitalia of *Ellabella*: 22, *E. chalazombra* (Meyrick), ♂ paralectotype, Yunnan, China [USNM slide 7756]; 23, same, detail of aedeagus (enlarged); 24, *E. bayensis*, n. sp., ♂ holotype [UCB], California [JBH slide 1721]; 25, same, detail of aedeagus [enlarged].



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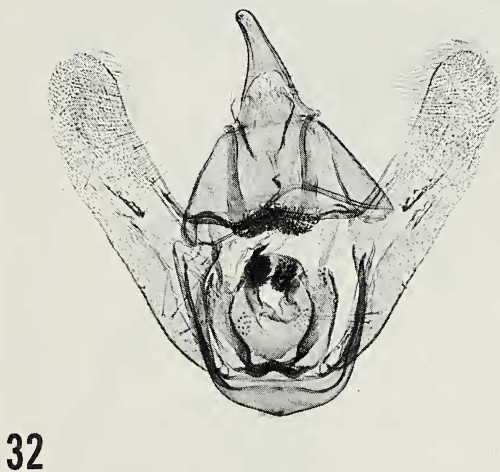
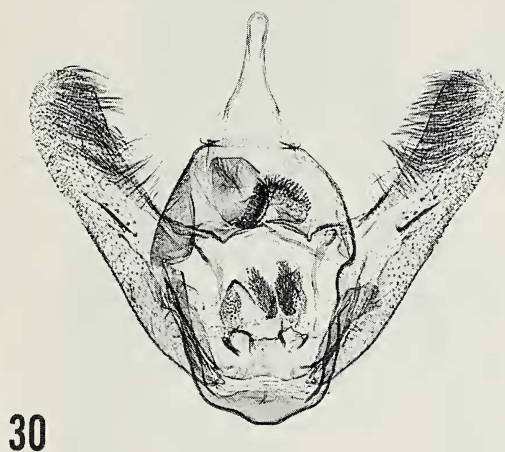


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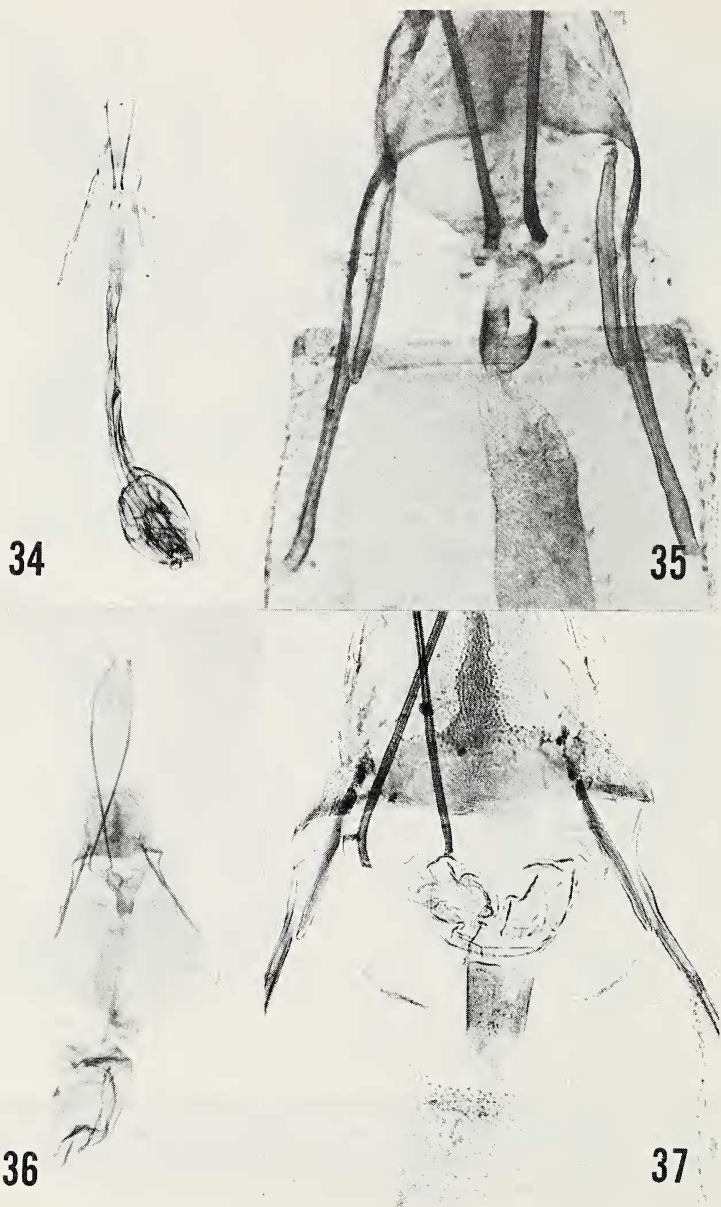


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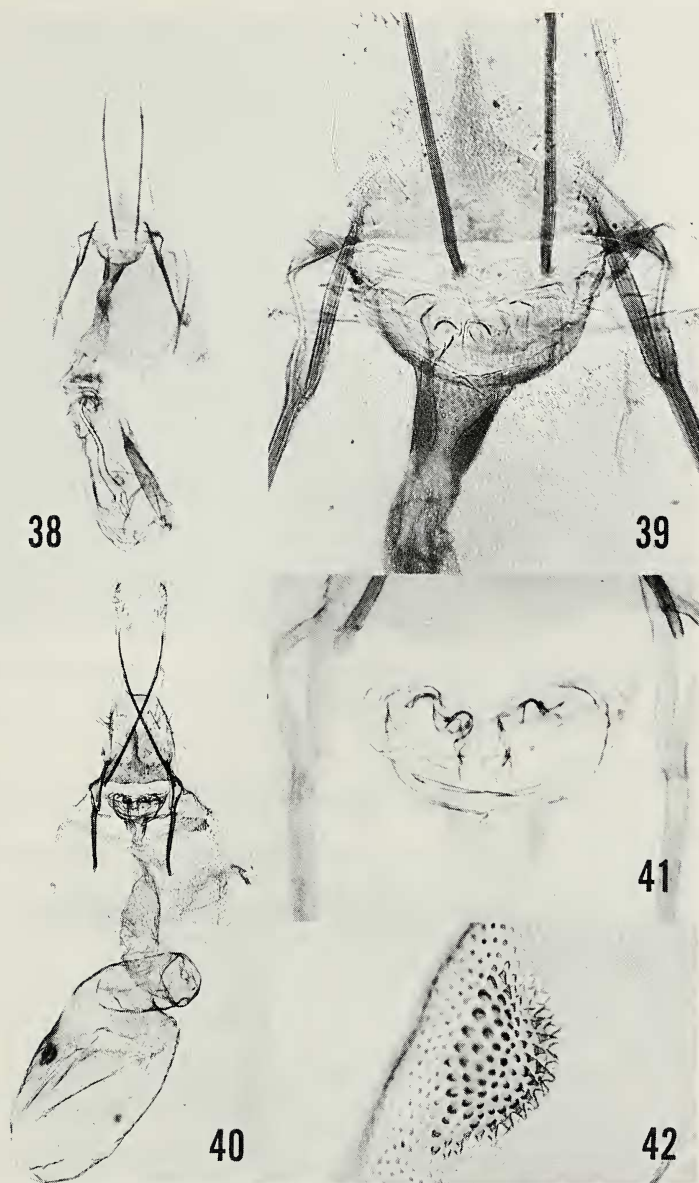
Figs. 26-29. Male genitalia of *Ellabella*: 26, *E. johnstoni*, n. sp., ♂ holotype (CNC), Washington (JBH slide 1672); 27, same, detail of aedeagus (enlarged); 28, *E. melanoclista* (Meyrick), Arizona (JBH slide 1677); 29, same, detail of aedeagus (enlarged).



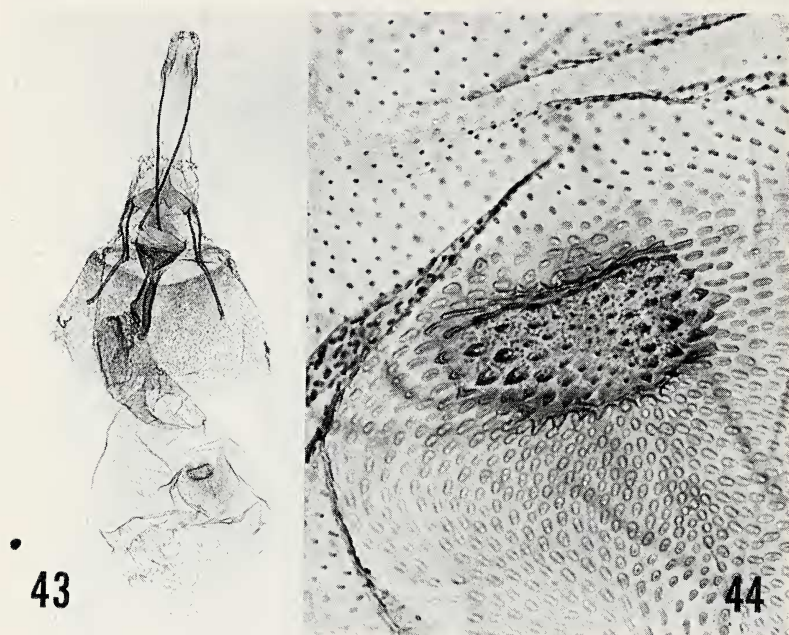
Figs. 30-33. Male genitalia of *Ellabella*: 30, *E. editha* Busck, British Columbia [USNM slide 77116]; 31, same detail of aedeagus (enlarged); 32, *E. editha*, Arizona [USNM slide 77758]; 33, same, detail of aedeagus (enlarged).



Figs. 34-37. Female genitalia of *Ellabella*: 34, *E. chalazombra* (Meyrick), ♀ paralectotype (MGAB), Yunnan, China (JBH 1646); 35, same, detail of ostium; 36, *E. bayensis*, n. sp., ♀ paratype (UCB), California (JBH slide 1723); 37, same, detail of ostium.



Figs. 38-42. Female genitalia of *Ellabella*: 38, *E. johnstoni*, n. sp., ♀ paratype, Washington (USNM slide 77757); 39, same, detail of ostium; 40, *E. melanoclista* (Meyrick), ♀ holotype (BMNH), Texas (after Clarke, [1965]:418); 41, same, detail of ostium; 42, same, detail of signum.



Figs. 43-44. Female genitalia of *Ellabell editha* Busck: 43, British Columbia [USNM slide 77203]; 44, same, detail of signum.

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